Construction Specification
378. POND

1. SCOPE

The work shall consist of furnishing materials and installing all components of the pond as outlined in this specification and the drawings.

Construction work covered by this specification shall not be performed between December 1st and the following March 15th unless the site condition and/or construction methods to be used have been reviewed and approved by the Engineer or his/her Representative.

2. MATERIALS

Unless otherwise set forth in Section10, the following materials are to be used for construction of a pond:

PORTLAND CEMENT shall be Type I, II, lA, or IIA, and conform to ASTMC150. If Type I or II is used, an air entrainment agent shall be used.

CONCRETE AGGREGATE shall meet the requirements and gradation specified in ASTM-C33. Coarse aggregate shall meet the gradation for size numbers 57 or 67.

WATER used in mixing or curing concrete shall be clean and free from injurious amounts of oil, acid, salt, organic matter or other deleterious substances.

REINFORCEMENT bars shall be grade 40 or higher, and shall conform to ASTM-A615, A616, or A617. Welded wire fabric reinforcement shall conform to ASTM-A185 or A497. Reinforcement shall be free from loose rust, oil, grease, curing compound, paint or other deleterious coatings.

CONCRETE ADMIXTURES shall conform to ASTM -C260 for air entrainment, and ASTM-C494, Types A, D, F, or G, for water-reduction and set-retardation.

POZZOLAN shall conform to ASTMC618, Class F, except loss of ignition shall not exceed 3.0 percent.

CURING COMPOUND shall meet the requirements of ASTM-C309, Type 2, Class A or B.

MASONRY COMPONENTS shall meet the requirements of ASTM C90 and C270, and shall be installed in accordance with ACI-530.

PRECAST CONCRETE UNITS shall comply with ACI-525 and 533.

PREFORMED EXPANSION JOINT FILLER shall conform to the requirements of ASTM-D1752, Type I, II or III, unless bituminous type is specified, in which case it shall conform to ASTM-D994 or D1751.

JOINT SEALERS shall conform to the requirements for ASTM-DI850, with "penetration" not greater than 120, or Federal Specification SS-S-210A; except that sealers for vertical or overhead application must meet the requirements of Federal Specification TT -S-227, Type II.

WATERSTOPS. Vinyl-chloride polymer types shall be tested in accordance with Federal Test Method Standard No. 601, and shall show no sign of web failure due to brittleness at a temperature of -35 degrees Fahrenheit. Colloidal waterstops shall be at least 75 percent bentonite in accordance with Federal Specification SS-S-210A.

DRAINFILL AGGREGATE AND BEDDING shall meet the requirements of PennDOT Specifications, Section 703.

ROCKFILL AND RIPRAP shall meet the material requirements: of PennDOT Specifications, Section 850.

PIPE AND APPURTENANCES shall meet the following requirements, unless otherwise set forth in Section 10:

STEEL PIPE, CORRUGATED - AASHTO Spec. M-l90, Type A

STEEL PIPE, CORRUGATED, BITUMEN COATING – AASHTO Spec. M-245 and M-246

STEEL PIPE, CORRUGATED, ALUMINUM COATING - AASHTO Spec. M-274

ALUMINUM PIPE, CORRUGATED - AASHTO Spec. M-196 or M-211.

PLASTIC PIPE - See Table 378-1

Appurtenances such as coupling bands, collars, end section, etc. shall be composed of the same material as the pipe and conform to the appropriate industry standard.

METALS shall conform to the following standards:

Structural steel - ASTM-A36
Carbon steel - ASTM-A283, grade C or D; or A611, grade D; or A570, grade C or D
Aluminum alloy - ASTM-B308, B429, B221, B210, B211, or B209
Bolts - ASTM-A307; zinc coating shall conform to ASTM-A153, B633 (cond. SC3), A165 (type TS)
Screws - wrought iron or medium steel
Split or tooth-ring connectors – hot-rolled, low carbon steel conforming to ASTM-A711, grade 1015.

TABLE 378-1

PLASTIC PIPE SPECIFICATIONS

Kind of Pipe	**ASTM** Specification
Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, 120	D1785
Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)	D2241
Polyethylene (PE) Plastic Pipe, Schedule 40	D2104
Polyethylene (PE) Plastic Pipe, (SIDR-PR) Based on Controlled Inside Diameter	D2239
Polyethylene (PE) Plastic Pipe, Schedules, 40 and 80 Based on Outside Diameter	D2447
Polyethylene (PE) Plastic Pipe, (SDR-PR), Based on Controlled Outside Diameter	D3035
Polyethylene (PE) Plastic Pipe, (SDR-PR), Based on Outside Diameter	F714
Acrylonitrile- Butadiene-Styrene (ABS), Plastic Pipe, Schedules 40 and 80	D1527
Acrylonitrile- Butadiene-Styrene (ABS), Plastic Pipe, (SDR-PR)	D2282
Large Diameter Corrugated Polyethylene Tubing & Fittings	F667
Polyethylene (PE) Large Diameter Profile Wall Sewer & Drain Pipe	F894
Type PSP PVC Sewer Pipe & Fittings	D3033
Type PSM PVC Sewer Pipe & Fittings	D3034

WOOD shall be graded and stamped by an agency accredited by the American Lumber Standards Committee as meeting the required species, grade, and moisture content. In the absence of such a stamp, the Contractor or material supplier shall provide written certification that the wood products meet the designated quality criteria.

PRESSURE TREATED WOOD PRODUCTS shall be Douglas Fir, Southern Yellow Pine, or as otherwise specified on the drawings or in Section 10. They shall be treated with preservatives in accordance with the American Wood Preservers Association (AWPA) Standard C16, "Wood Used on Farms, Pressure Treatment." Each piece shall bear the AWPA stamp of quality. In the absence of such a stamp, the Contractor or material supplier shall provide written certification that the pressure treated wood meets the designated quality criteria.

GEOTEXTILE shall conform to the requirements of PennDOT Specifications 735 and 212 for the class applicable to its use.

3. FOUNDATION PREPARATION

All trees, brush, fences, and rubbish shall be cleared within the areas of the embankment, spillways, appurtenances, and borrow areas. All stumps, roots and rubbish shall be removed from these areas to a depth of at least six inches below the existing ground surface. Unless otherwise set forth in Section 10, all trees, brush, fences, and rubbish shall be cleared from the pool area. All material removed by the clearing and grubbing operation shall be disposed of as directed by the Owner or his/her Representative. Sufficient topsoil should be stockpiled in a convenient location for use on the embankment and other disturbed areas to facilitate seeding. Final grading of the embankment foundation prior to any fill placement shall remove all unsuitable rock and soil, and any slopes steeper than 1: 1.

For excavated ponds, the pool area shall be excavated to the lines, grades and elevations shown on the drawings. Unless specified in Section 10, the materials excavated from the pond shall be placed in one of the following ways so that its weight will not endanger the stability of the pond side slopes, and where it will not be washed back into the pond by rainfall:

a. Uniformly spread to a height not exceeding three feet with the top graded to a continuous slope away from the pond.

b. Uniformly placed or shaped, with side slopes assuming the natural angle of repose for the excavated material, and set a distance from the pond edge equal to the depth of the pond, but not less than 12 feet.

c. Hauled away as directed by the Landowner.

4. CUTOFF TRENCH

Where specified, a cutoff trench shall be excavated along or parallel to the centerline of the earthfill, as shown on the plans. Unless otherwise shown on the drawings, the bottom width of the trench shall be governed by the equipment used for excavation, but not less than four feet.

The minimum depth of the cutoff trench shall be three feet or as otherwise shown on the drawings. If large boulders or bedrock is encountered in the excavation, the minimum depth will not be required if, in the opinion of the Engineer, the trench cannot be excavated to the required depth. The bedrock or boulders shall be cleared of all loose materials to insure adequate compaction of backfill material to the rock. The side slopes of the trench shall be one-

on-one or flatter, or as otherwise shown on the drawings.

The backfill material for the cutoff trench shall be the most impervious material available and shall be compacted as set forth in Section 6 for embankment fill. Where rock is encountered, the fill material shall be placed in three-inch layers and compacted by hand or mechanical tampers. Backfilling shall continue in three-inch layers until the depth of fill over the rock is such that acceptable density may be obtained by using construction equipment with a maximum of six-inch layers for the compaction operation.

5. PIPES

Excavation for pipes shall be made to the grades and lines shown on the plans or as indicated by construction stakes. Care should be taken not to excavate below the depths specified. Excavation below the design grade shall be corrected by firmly compacting layers of moist earth to provide a good foundation.

If rock or boulders are exposed in the bottom of the excavation, they shall be removed to a minimum depth of eight inches below the bottom of the pipe and, where applicable, below the bottom of anti-seep collars, and replaced with firmly compacted earth to the specified grade. Pipes shall be firmly and uniformly bedded.

Pipes shall be of the materials set forth in Sections 2 and 10, or as otherwise shown on the drawings.

All pipe connections shall be watertight. Anti-seep collars, where used, shall also be connected to pipes in such a manner as to be watertight. Helically corrugated pipe shall have, as a minimum, either continuously molded seams or lock seams which are caulked, during fabrication, with a neoprene bead. Bell and spigot pipe shall be placed with the bell end upstream.

Any bituminous coating which is damaged shall be repaired with cold applied bituminous coating compound. Aluminum surfaces that are to be in contact with concrete shall be painted with one coat of zinc chromate primer. Hot dipped galvanized bolts may be used for connections.

6. EMBANKMENT

The fill material for the embankment shall be obtained from the designated borrow areas and/or required excavations. The material shall be free from stumps, wood, brush, roots, sod, rubbish, and other matter that may decay. It should also be free of stones over two inches in diameter where compacted by hand or mechanical tampers, or over six inches in diameter where compacted by rollers or other driven equipment. Frozen material shall not be placed in the fill nor shall the fill material be placed on a frozen foundation.

Prior to placing the fill material on any portion of the foundation, that portion shall be scarified, plowed, or disked to a depth of three-inches. All objectionable material exposed by this operation, i.e., other than the mineral soil that has been identified for use as fill, shall be disposed of as directed by the Owner.

Fill material shall be placed and spread beginning at the lowest point of the foundation and then bringing it up in horizontal layers thick enough that the required compaction can be obtained. The fill shall be constructed in continuous horizontal layers. If openings or sectionalized fills are required, the slope of the bonding surfaces between the embankment in place and the embankment to be placed shall not be steeper than a ratio of three horizontal to one vertical.

The bonding surface shall be treated the same as that specified for the foundation to insure a good bond with the new fill. The distribution and gradation of materials shall be such that no lenses, pockets, streaks, or layers of material shall differ substantially in texture or gradation from the surrounding material. If it is necessary to use materials of varying texture and gradation, the more impervious material shall be placed in the center and upstream parts of the fill. If zoned fills of substantially differing materials are specified, the zones shall be placed according to lines and grades shown on the drawings.

The thickness of each layer of fill prior to compaction shall be no greater than eight inches for sheepsfoot rollers, six inches for rubber-tired compaction equipment, or four inches for track-type compaction equipment, unless otherwise specified. Materials placed on the fill by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness prior to compaction.

Adjacent to structures, fill shall be placed in a manner adequate to prevent damage to the structure and to allow the structure to gradually and uniformly assume the backfill loads. Backfill adjacent to structures shall be placed in layers not thicker than four inches prior to compaction. The height of the backfill shall be increased at approximately the same rate on all sides of the structure during placement.

Each layer of fill material shall be compacted by routing the construction equipment so that all parts of each layer are equally compacted. Each layer shall receive at least three passes of a sheepsfoot roller or track-type equipment or five passes of rubber-tired compaction equipment, unless otherwise specified on the drawings or in Section 10. Fill material should contain sufficient moisture so that it can be formed into a ball without crumbling. If water can be squeezed out of the ball, it is too wet to compact properly and shall be dried prior to compaction. Dry soil shall be wetted and mixed prior to compaction.

Fill adjacent to structures, pipe conduits, and drainfill or anti-seep collars shall be compacted to a density equivalent to that of the surrounding fill by hand tamping or by using manually directed power tampers or plate vibrators. Heavy equipment shall not be operated within two feet of any structure. Compaction by means of drop weights operating from a crane or hoist of any type will not be permitted. Fill adjacent to concrete structures shall not be compacted until the concrete has had time to gain enough strength to support the load.

Drainfill, where required, shall be placed to the line and grade shown on the drawings. Detailed requirements for drain material and any required drainpipe shall be as shown in the drawings.

7. CONCRETE APPURTENANCES

CONCRETE MIX

Unless otherwise specified in Section 10, concrete shall be proportioned to provide a minimum compressive strength at 28 days of 4,000 psi. The Contractor shall be responsible for the design of the mix and certification of the necessary strength, in accordance with ACI 301. Acceptance and certification of design mixes by PennDOT within the past year may be accepted in lieu of additional testing.

REINFORCING STEEL PLACEMENT

Reinforcement shall be accurately placed and secured in position in a manner that will prevent its displacement during the placement of concrete.

Steel shall be supported by precast concrete bricks (not clay bricks), metal or plastic chairs, or hard fieldstone. Except for

dowel rods, placing steel reinforcement into concrete already in place shall not be permitted.

The following tolerances will be allowed in the placement of reinforcing bars shown on the drawings:

(1) Maximum reduction in cover:
from exposed surfaces -1/4 inch
from earth surfaces -1/2 inch

(2) Maximum variation from indicated spacing:
1/12th of indicated spacing

Splices of reinforcing bars shall be made only at the locations shown on the drawings, unless otherwise approved by the Engineer. Unless otherwise required, welded wire fabric shall be spliced by overlapping sections at least one full mesh dimension plus too inches. All reinforcement splices shall be in accordance with ACI 318.

Reinforcing steel shall not be welded unless approved by the Designer.

The ends of all reinforcing steel shall be covered with at least 1-1/2 inches of concrete.

MIXING AND HANDLING CONCRETE

In general, concrete shall be transported and placed in accordance with ACI-304, of which some specific interpretations are set forth below.

For concrete mixed at the site, the mixing time after all cement, aggregates and water are in the mixer drum shall be at least 1-1/2 minutes. Concrete shall be conveyed from the mixer as rapidly as practical by methods that will prevent segregation of the aggregates or loss of mortar. Concrete shall be placed within 1-1/2 hours after the introduction of cement to the aggregate unless an approved set-retarding admixture is used in the mix. During periods of hot weather, it may be necessary to reduce this time.

For each load of concrete delivered to the site, a batch ticket shall be provided to the Owner or Technician by the Supplier. As a minimum, this ticket shall show the design strength, time out, admixtures (if any), and amount of water that may be added (if any) on site and still be within the design mix limits.

The Contractor shall test slump and air entrainment as necessary to insure that the concrete meets the requirements of this specification. The slump shall be three to six inches (without superplasticizers) and the air content shall be five to seven percent of the volume of the concrete. Admixtures such as superplasticizers, water-reducers and set-retarders may be used provided they are approved by the Engineer prior to concrete placement and are used in accordance with the manufacturer's recommendations. Superplasticizers (ASTM C494, Type F or G) may be added to concrete that has a 2 to 4 inch slump before the addition, and that is not warmer than 95^{o} F. The slump shall not exceed 7½ inches with the addition of superplasticizer.

Concrete shall be uniform and thoroughly mixed when delivered to the job site. Variations in slump of more than one inch within a batch will be considered evidence of inadequate mixing and shall be corrected or rejected. No water in excess of the amount called for by the job design mix shall be added to the concrete.

Immediately after placement, concrete shall be consolidated by spading and vibrating, or spading and hand tamping. It shall be worked into corners and around all reinforcement and embedded items in a manner which prevents segregation. Excessive vibration which results in segregation of materials will not be allowed. Vibration must not be used to make

concrete flow in forms, slabs, or conveying equipment.
If the surface of a layer in place will develop its initial set, i.e., will not flow and merge with the succeeding layer when vibrated, a construction joint shall be made.
Construction joints shall be made by cleaning the hardened concrete surface to exposed aggregate by sandblasting, air/water jetting, or hand scrubbing with wire brush, and keeping the concrete surface moist for at least one hour prior to placement of new concrete.

Concrete surfaces do not require extensive finishing work; however, the surface shall be smooth and even. Careful screeding (striking-off) and/or wood float finishing shall be required, unless otherwise shown on the drawings. Any additional desired finishing of the surface (such as roughening for improved traction on ramps) shall be accomplished after an initial stiffening of the concrete has taken place. Exposed edges should be chamfered, either with form molding or molding tools.

The addition of dry cement or water to the surface of screeded concrete to expedite finishing is not allowed. If concrete placing is discontinued prior to completion of the entire structure, the unfinished end of the concrete shall be formed to create a proper construction or expansion/contraction joint.

EXPANSION/CONTRACTION JOINTS

When required in Section 10 or on the drawings, expansion/contraction joints shall contain a six-inch, Type B, vinyl waterstop with a minimum web thickness of 1/8-inch, or an approved joint sealer.
FORM REMOVAL AND CONCRETE REPAIR

Forms for walls and columns shall not be removed for at least 24 hours after placing the concrete. When forms are removed in less than seven days, the exposed concrete shall be sprayed with a curing compound or be kept wet continuously for the remainder of the curing period. Forms which support beams or covers shall not be removed for at least seven days, or 14 days if they are to support forms or shoring.

Forms shall be removed in such a way as to prevent damage to the concrete. Forms shall be removed before walls are backfilled. Columns shall be at least seven days old before any structural loads are applied.

Concrete that is damaged or otherwise defective shall be removed and replaced, or where feasible, repaired. The Engineer will determine the required extent of removal, replacement or repair. The plan for accomplishing the repair must be approved by the Engineer prior to beginning the repair work. Where minor areas of the concrete surface are "honeycombed," damaged or otherwise defective, the area may be cleaned, wetted and then filled with a dry-pack mortar. Dry-pack mortar shall consist of one part Portland cement and three parts sand with just enough water to produce a workable paste.

CONCRETING IN COLD WEATHER

Concreting in cold weather shall be performed in accordance with ACI-306R. In addition, the contractor shall provide a written plan at least 24 hours in advance of placing concrete in cold weather, and shall have the necessary equipment and materials on the job site before the placement begins. Regardless of cold weather procedures, concrete placement will not be permitted when the air temperature during placement and the following 24 hours is predicted to full below 32 degrees Fahrenheit.

CONCRETING IN HOT WEATHER

Concreting in hot weather shall be performed in accordance with ACI 305, of which some specific interpretations are set forth below.

The supplier shall apply effective means to maintain the temperature of concrete below 90 degrees) Fahrenheit during mixing and conveying. Exposed surfaces shall be continuously moistened by means of fog spray or otherwise protected from drying during the time between placement and finishing, and during curing. Concrete with a temperature above 90 degrees Fahrenheit shall not be placed.

CURING

In general, concrete shall be cured in accordance with ACI-308. Specifically, it shall be prevented from drying for at least seven days after it is placed. Exposed surfaces shall be kept continuously moist during this period by covering with moistened canvas, burlap, straw, sand or other approved material unless they are sprayed with a curing compound.

Concrete, except at construction joints, may be coated with a curing compound in lieu of continuous application of moisture. The compound shall be sprayed on moist concrete surfaces as soon as free water has disappeared but shall not be applied to any surface until patching, repairs and finishing of that surface are completed. Curing compound shall not be allowed on any rebars.

Curing compound shall be applied in a uniform layer over all surfaces requiring protection at a rate of not less than one gallon per 150 square feet of surface. Surfaces subjected to heavy rainfall or running water within three hours after the curing compound has been applied, or otherwise damaged, shall be resprayed. Any construction activity which disturbs the curing material shall be avoided. If the curing material is subsequently disturbed, it shall be reapplied immediately.

8. EROSION CONTROL AND WATER REMOVAL

All work on permanent structures shall be carried out in areas free from water. The Contractor shall construct and maintain all temporary dikes, levees, cofferdams, drainage channels, and stream diversions necessary to protect the areas to be occupied by the permanent works. The Contractor shall also furnish, install, operate, and maintain all necessary pumping and other equipment required for removal of water from the various parts of the work and for maintaining the excavations, foundation, and other parts of the work free from water as required or directed by the Engineer for constructing each part of the work. After having served their purpose, all temporary protective works shall be removed or leveled and graded to the extent required to prevent obstruction in any degree whatsoever of the flow of water to the spillway or outlet works and so as not to interfere in any way with the operation or maintenance of the structure. Stream diversions shall be maintained until the full flow can be passed through the permanent works.

The removal of water from the required excavation and the foundation shall be accomplished in a manner and to the extent that will maintain stability of the excavated slopes and bottom of required excavations and will allow satisfactory performance of all construction operations. During the placing and compacting of material in required excavations, the water level at locations being refilled shall be maintained below the bottom of the excavation. Such locations may require draining the water to sumps from which the water shall be pumped to settling basins. Construction operations will be carried out in such a manner that erosion will be controlled and water and air pollution minimized. State and Local laws concerning pollution abatement will be followed.

9. SEEDING

A protective cover of vegetation shall be established on all exposed surfaces of the embankment, spillway, and borrow areas to the extent practicable under prevailing soil and climatic conditions. The embankment and spillway shall be fenced where shown on the drawings to protect the vegetation. Sodding, liming, seeding, fertilizing and mulching shall conform to the standards for permanent seeding in the Pennsylvania Technical Guide available, and as otherwise set forth in Section 10.

10. ADDITIONAL CONDITIONS WHICH APPLY TO THIS PROJECT ARE: